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August 4, 1992

VIA HAND DELIVERY

Mr. H. Frank Wright
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Re: File Nos. 2303-EX-PL-91
2304-EX-PL-91
2305-EX-PL-91
2306-EX-PL-91
2307-EX-PL-91

Dear Mr. Wright:

TRW, Inc. ("TRW") hereby responds to a letter from Motorola Satellite Communications, Inc. ("Motorola"), dated July 22, 1992 ("Motorola Letter") in response to your letter of July 17, 1992 (Reply Reference No. 1300A4), in which you requested additional information in support of the fourth phase of Motorola's proposed experiment for its "Iridium" satellite system.

Motorola's letter is a further attempt to cloak its purported multi-million dollar, one-year, in-orbit satellite project in the garb of an innocent test of new satellite technology. Despite Motorola's continued protestations to the contrary, its "experiment" remains nothing more than an attempt to begin premature construction of the Iridium system as a way of gaining an unfair licensing and competitive advantage over TRW and Motorola's other competitors.

In your letter of July 17, you asked Motorola to explain why its primary objectives in the fourth phase of its experiment would not be met by the simulations in the first three phases or by tests with fewer satellites. In addition, you asked Motorola to explain how its objectives of verification, engineering evaluation and functional

demonstration of its design concept required the launch of six low earth orbiting satellites. Motorola's response to your inquiries is riddled with evasive answers, inaccuracies and omissions.

Motorola claims that "...computer simulations...cannot be relied upon exclusively for such a large and complex satellite system as the Iridium system." Motorola Letter ¶ 4. However, many of the software packages used for the type of simulations discussed by Motorola were originally developed by other aerospace companies precisely because in-orbit experiments were a needless waste of money, time and resources. Large and complex government communications satellite programs such as NASA's Tracking and Data Relay Satellite System (TDRSS) -- built by TRW -- have relied on simulations of all their key parameters in order to assure their proper operation prior to launch.

Motorola states vaguely that "[p]arametric estimates must be introduced into the simulations in order to obtain test results with the required degrees of confidence and accuracy." Motorola Letter ¶ 5. In addition, Motorola claims that investors and service providers in the Iridium system will demand such in-orbit experimentation and testing before committing to the project. Id. Motorola does not need to generate its "parametric estimates" in a space environment to convince engineers, investors or service providers of the system's viability. TRW did not need to launch experimental satellites to prove the viability of the TDRSS system or of the Department of Defense's (DOD) MILSTAR payload, which is now in the final stages of assembly and testing and is scheduled for imminent launch. An in-orbit "show" simply for investors would be ridiculously extravagant.

Motorola goes so far as to assert that in-orbit experimentation and testing are "vital" to the ultimate frequency coordination of the Iridium system. Motorola Letter ¶ 6. There is absolutely no valid technical reason why frequency coordination cannot be established by aircraft and ground tests instead. Filters and antennas operate with no significant difference on earth than they do in space. Furthermore, it is questionable whether any competent engineer would wait until a system were unreachable in space to verify such critical parameters as those involved in frequency coordination.

Motorola's stated belief that "prototype testing presents the most economical alternative" for achieving the objectives of its experiment is dangerously misguided. Motorola Letter ¶ 7. In fact, prototype testing in space is

the least economical method of achieving Motorola's objectives. The price of failure once Motorola's satellites are in orbit would be monumental in comparison to the price of failure during ground-based tests. Given that Motorola requires 77 satellites in order to operate its proposed Iridium system, the resale value of the handful of satellites that it proposes to launch in its experiment would be minimal.

Having initially asserted that it required seven satellites to conduct its experiment, October 16, 1991, Motorola Satellite Communications, Inc., Application for Authority to Conduct a Comprehensive Testing Plan for its Proposed IRIDIUM Satellite System, and then claimed that it needed only six satellites and could conduct most of its experiments with as few as four, March 18, 1992, Opposition to Petition to Deny, Motorola now asserts that "it is essential that it be given authority to construct and launch at least five experimental satellites in order to maintain an effective experimental testing program." Motorola Letter ¶ 9. The inconsistency in Motorola's requests certainly brings into question the coherence of its plans for its experiment.

Of even greater significance, however, is Motorola's apparent fixation on the Delta-class launch vehicle as the sole means of propelling its satellites into orbit. Motorola continues to suggest that it must launch multiple satellites "because of the cost efficiencies associated with utilizing the full capacity of the Delta-class launch vehicle...." Motorola Letter at ¶ 8. The qualities of Delta-class launch vehicles are irrelevant to the number of satellites Motorola launches. Other types of launchers exist which can lift just one satellite into orbit.

As another argument for launching multiple satellites, Motorola now claims that it needs to "test links between orbital planes." Motorola Letter ¶ 9. Such "cross plane" or "cross link" tests are also no reason to launch five (or seven, or six, or four) satellites into orbit. Many satellites that routinely perform cross link communication have been built, launched and successfully operated. The TDRSS system uses cross links as the backbone of the National Aeronautics and Space Administration's (NASA) communications network to support all low earth orbit communications and tracking needs.

Motorola disingenuously lists "satellite function verification" as one of the principle features and capabilities that it plans to address through its in-orbit tests, and offers "autonomous call switching" as an example of a function that it wishes to verify. Motorola Letter ¶ 11. As Motorola well

knows, all builders of space communications systems use thermal/vacuum testing to verify all system elements on the ground under realistic orbital conditions. DOD's MILSTAR system and NASA's Advanced Communication Technology Satellite (ACTS) system have both demonstrated switching systems by means of thermal/vacuum tests. Motorola cannot claim ignorance of such tests because it is a subcontractor for a portion of the ACTS payload.

Motorola also claims to wish to test "intersatellite communications links" through its in-orbit tests. Motorola Letter ¶¶ 12, 13. Satellite cross link communications systems have been in use for years. The most fundamental mode of operation for NASA's TDRSS satellites involves a cross link between the system's satellites and user satellites. Tests of switching and networking capability are best conducted on the ground, as demonstrated by the ACTS and MILSTAR systems.

Although Motorola claims that it needs to test "launch vehicle capabilities" and "dispensing and orbit injection procedures," Motorola Letter ¶ 14, such technologies are well understood by competent satellite system engineers. The DOD employed such technologies in the multiple satellite launches for its Global Positioning System (GPS). Motorola therefore has no need to conduct costly experiments to demonstrate that such technologies can work.

Motorola is quite correct that it needs to conduct tests of its ability to maintain the orbital parameters of each satellite, the spacing between satellites, and the altitude of each satellite in its 77-satellite system. See Motorola Letter ¶ 15. However, Motorola will not be able to verify the viability of such a complex system by launching five or six satellites. Extrapolation from the behavior of five or six satellites to the behavior of 77 is unreliable; if extrapolation were reliable, Motorola would only need to launch two or three satellites to predict the behavior of all the satellites in its Iridium system. The only reasonable and economical way for Motorola to test such features of its system is by means of land-based simulations.

Motorola has never built and launched an entire satellite, or even an entire payload for one satellite. The prospect of building and launching a constellation of 77 satellites, complete with cross links, must therefore be sobering indeed for Motorola's engineers. Motorola's inexperience, however, is no reason for it to undertake absurdly expensive experiments. The technologies that Motorola plans to employ are not novel, and Motorola could easily avail

itself of the knowledge of more competent builders of space-based communications systems through subcontracting and/or teaming arrangements.

However, Motorola clearly has other plans. The only possible explanation for its eagerness to risk millions of dollars to conduct pointless experiments with multiple orbiting satellites lies in its hope of gaining an improper and unfair licensing and competitive advantage over its competitors. Motorola plainly hopes that, by spending large sums of money to launch a portion of its Iridium system under the guise of an "experiment," it will be able to convince the Commission to grant its application for a license for the full Iridium system.

As you noted in your letter to Motorola on July 17, it is the Federal Communications Commission's intention to insure that ". . . the grant of a license to permit experimental satellite service does not create any future obligation by the Commission to allocate spectrum permanently to grant license[e]s." Motorola's proposed "experiment" is a blatant attempt to establish just such a "future obligation." As TRW has noted previously in its Petition to Deny on March 5, 1992, and in its Reply of TRW, Inc. of March 31, 1992, Motorola's "experiment" is an attempt to circumvent Title III of the Communications Act and the Commission's regulations. TRW therefore respectfully urges the Commission to deny Motorola's applications for experimental authority insofar as they relate to the construction, launch and operation of Iridium satellites.

Respectfully submitted,

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